

ON A NEW GENUS OF POGONOPHORE FROM THE WESTERN ATLANTIC OCEAN, WITH DESCRIPTIONS OF TWO NEW SPECIES

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ABSTRACT

Two species of Pogonophora are described, one from the northwestern Atlantic between New England and Bermuda, the other from near the coast of Brazil. Both have two tentacles and inhabit black tubes. They are assigned to a new genus and placed, tentatively, in the family Polybrachidae.

INTRODUCTION

The pogonophores described in this paper were first collected by Dr. H. L. Sanders and Dr. R. R. Hessler of the Woods Hole Oceanographic Institution, during their investigations of the benthos of the western Atlantic Ocean. Later some more specimens were found by Dr. R. L. Wigley of the Bureau of Commercial Fisheries Biological Laboratory, Woods Hole. The pogonophores are unusual two-tentacled forms, which do not belong to any of the known genera. They have already been mentioned briefly, unnamed, in a paper on Atlantic pogonophores (Southward & Southward, 1967).

DESCRIPTIONS

Crassibrachia, new genus

Pogonophora with two swollen tentacles lacking pinnules. The forepart of the body has two or three shallow transverse grooves between the tentacle bases and the bridle. The forepart and trunk are separated by a normal diaphragm (septum) and an external groove. The pyriform glands of the metameric region are contained in papillae. Oval adhesive plaques are present on some of the metameric papillae. There are two girdles of toothed platelets. The postannular papillae are arranged in rows of 3 or 5, associated with very small dorsal shields. The spermatophores are elongated, narrow, and slightly flattened.

Crassibrachia sandersi gen. nov., sp. nov.

Occurrence.—Northwestern Atlantic Ocean (see Table 1 for details of stations); depth range 2,000-5,000 meters.

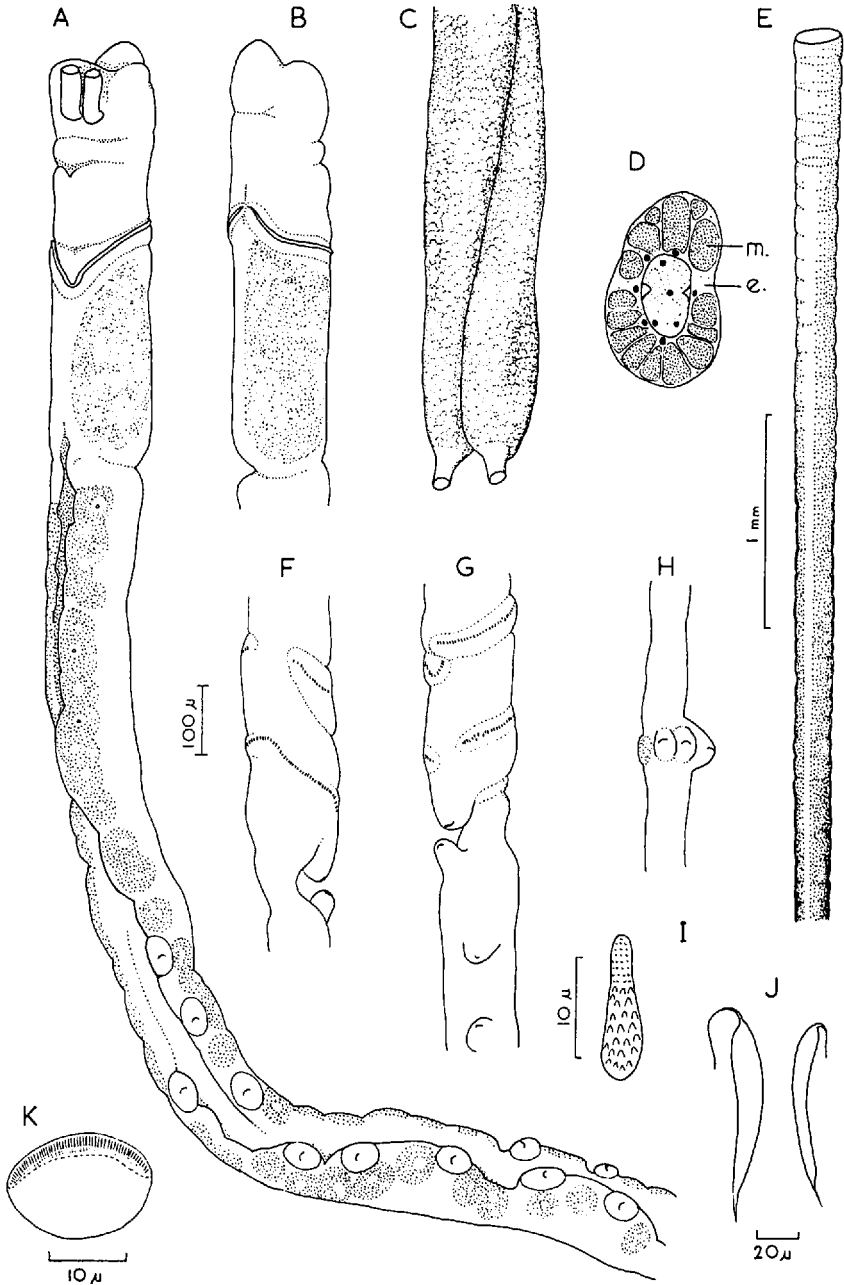
Type Locality.—Station No. ATLANTIS II 95.

Material.—A large number of fragmentary tubes, many containing animals of both sexes and embryos.

Holotype.—U. S. National Museum No. 36128.

Description.—The small black tubes are very brittle and the animals have been extracted by squeezing and pulling, hence most of them are in fragments. The two swollen-looking tentacles lie side by side or loosely coiled together and completely fill the tube. The swollen appearance is produced by the presence of large numbers of vesicular mucus cells in the epidermis (Fig. 1, C, D). These cells are translucent, and the whole epidermis has a bubbly look.

The small cephalic lobe is itself lobed into three parts (Fig. 1, A). Between the attachment of the tentacles and the bridle are two or three incomplete transverse grooves, all of which are deepest on the ventral side. In some specimens there is also a shallow longitudinal ventral groove. The thick bridle keels are yellowish-brown to dark brown, and seem to be made up of small blocks cemented together, as in some other pogonophores. The keels fuse on the ventral side to make a smooth curve, but are separated by a slight furrow dorsally (Fig. 1, A, B). Behind the bridle are lateral patches of white or yellowish epidermis, made up of cells with fine granular contents, equivalent to the white protein cells of *Siboglinum atlanticum* (Southward & Southward, 1966). The same kind of cell occurs abundantly on the metameric part of the trunk, giving the metameric papillae a white or yellowish colour. The diaphragm between forepart and trunk is accompanied by a shallow, transverse, external groove, though this groove is often incomplete ventrally (Fig. 1, A). The anterior part of the trunk bears two rows of papillae, with as many as 30 metameric papillae. Adhesive plaques are present on some of the papillae, usually beginning between the 12th and 15th, and lying on small cushions of translucent cells (Fig. 1, A). These plaques are oval in shape and 20-27 μ in greatest diameter. Behind the metameric region is a region of the trunk with only a few, small, scattered papillae, some of which bear plaques while others contain pyriform glands. There follows a thickened region bearing as many as 27 large ventral papillae and dorsal ciliated area. The large papillae, some of them double, are tipped with cuticular plaques 20-25 μ in diameter. The two girdles are separated from this region by only a short section with scattered small papillae. The toothed platelets of the girdles are arranged in single or semi-double rows; they are rather small (10-13 μ long), and oval or elongate in shape (Fig. 1, I). The anterior girdle is made up of two half-hoops, separated dorsally by a gap, but either almost touching or overlapping ventrally. The posterior girdle is continuous dorsally and interrupted ventrally. The postannular papillae are arranged in transverse rows of 5 or occasionally 6, opposed by a small dorsal shield composed of two little patches of granule-containing cells (Fig. 1, H). The spermatophores are long and



tapering but flattened, not cylindrical (Fig. 1, J). Their length varies in different animals from 75-115 μ .

Measurements.—The tentacles are as much as 5 mm long; the forepart is from 0.55-0.82 mm long, with a maximum diameter of 0.16 mm, and a length/diameter ratio of 4 or 5 to 1. The preannular part of the trunk is from 13-25 mm long in a mature animal, with metameric papillae on the first 2-3 mm. The complete postannular region has not been found, and the posterior setigerous bulb is unknown. Some young specimens are smaller than this, and have either one tentacle or one long and one short one.

Tube.—The densely black tubes are stiff, wiry yet brittle, and about 0.2 mm in diameter at the anterior end, tapering to about 0.15 mm posteriorly. They have a short anterior section with transparent, brownish or yellowish walls, then several centimeters with black walls, followed by a posterior, transparent region which is brown at first and becomes gradually colourless and limp. Most of the tube is smooth surfaced, but up to 20 mm of the anterior end may be divided into short "segments" by slight constrictions (Fig. 1, E). These segments do not overlap like those of *Polybrachia* and *Lamellisabella*, but do resemble them in being formed at the anterior end of the tube. Many of the smaller tubes have a smooth, unsegmented anterior end. The total length of the tube is probably about 10 cm.

Embryos.—Developing embryos are present in some of the tubes collected in December 1965. At the stage when the first tentacle is forming, they have an unusually small cephalic lobe (Fig. 2). At this stage there are two pairs of toothed platelets on each side of the mesosoma, as in *Siboglinum* (Jägersten, 1957; Webb, 1964a; personal observations).

Ecology.—The habitat of *Crassibrachia sandersi* lies within the depth range of 2,000-5,000 m, from the continental rise off New England, across the abyssal plain to the Bermuda rise. It occurs along the continental rise from south of Georges Bank to east of New Jersey, a distance of more than 400 km, and probably it will be found to be more widely distributed than this. The typical black tubes, often empty, have been found in most depths below about 2,400 m, but inhabited tubes seem to be commonest between 2,900 and 3,900 m.

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FIGURE 1. *Crassibrachia sandersi*: A, forepart and metameric region, ventral view; B, forepart, dorsal view; C, proximal parts of tentacles; D, transverse section of tentacle (m, mucus cell; e, unmodified epidermal cell); E, anterior end of tube; F, girdle region, dorsal view; G, girdle region, ventral view; H, postannular group of papillae; I, toothed platelet; J, spermatophores, face and side views; K, adhesive plaque from metameric region.

TABLE 1
DISTRIBUTION OF *Crassibrachia sandersi*

Ship	Station	Date	Position	Depth (m)	Gear	No. of animals
ATLANTIS	HH 3	May 21, '61	38°47'N; 70°08'W	2900	AD	7
"	II 1	May 22, '61	37°59'N; 69°32'W	3742	AD	several
"	II 2	May 24, '61	38°05'N; 69°36'W	3752	AD	several
"	KK 1	Aug 10, '61	36°23.5'N; 68°04.5'W	4850	AD	tubes only
"	00 2	May 27, '62	33°06.7'N; 65°02.2'W	4667	AD	tubes only
"	58	Sep 7, '63	38°34'N; 72°55'W	2000	AD	tubes only
ATLANTIS II	63	Aug 21, '61	38°46.8'N; 70°05.7'W	2891	AD	tubes only
"	64	Aug 21, '64	38°46'N; 70°06'W	2886	ET	1
"	65	Aug 21, '64	38°46.8'N; 70°06.8'W	2891	AD	tubes only
"	66	Aug 21, '64	38°46.7'N; 70°08.8'W	2802	ET	tubes only
"	70	Aug 23, '64	36°23'N; 67°58'W	4680	ET	tubes only
"	71	Aug 24, '64	38°08'N; 71°47.5'W	2946	AD	2
"	72	Aug 24, '64	38°16'N; 71°47'W	2864	ET	tubes only
GOSNOLD	2117	Aug 14, '64	38°15.6'N; 72°29'W	2910	CG	tubes only
"	2118	Aug 14, '64	38°14.4'N; 72°16'W	2975	CG	tubes only
"	2144	Aug 17, '64	38°59.2'N; 70°29.3'W	2850	CG	tubes only
"	2145	Aug 18, '64	38°53'N; 69°59'W	2925	CG	1
"	2147	Aug 18, '64	39°30.8'N; 70°00'W	2435	CG	tubes only
"	2154	Aug 19, '64	39°08.3'N; 69°27.8'W	2840	CG	4
"	2155	Aug 19, '64	39°05'N; 68°59'W	3080	CG	tubes only
"	2164	Aug 20, '64	39°24.3'N; 68°20'W	3015	CG	tubes only
"	2165	Aug 20, '64	39°09.2'N; 68°08.9'W	3310	CG	1
"	2168	Aug 21, '64	39°41'N; 67°58.7'W	2950	CG	tubes only
CHAIN	76	June 29, '65	39°38.3'N; 67°57.8'W	2862	ET	tubes only
"	77	June 30, '65	38°00.7'N; 69°16'W	3806	ET	1
"	78	June 30, '65	38°00.8'N; 69°18.7'W	3828	ET	2
"	80	July 2, '65	34°49.8'N; 66°34'W	4970	ET	tubes only
"	83	July 3, '65	34°46.5'N; 66°30'W	5000	ET	tubes only
"	84	July 4, '65	36°24.4'N; 67°56'W	4749	ET	tubes only
"	85	July 5, '65	37°59.2'N; 69°26.2'W	3834	ET	2
"	86	July 5, '65	37°59'N; 69°18.5'W	3843	ET	tubes only
ATLANTIS II	92	Dec 13, '65	36°20'N; 67°56'W	4694	ET	1
"	95	Dec 17, '65	38°33'N; 68°32'W	3753	ET	16

Gear used: AD = anchor dredge; ET = epibenthic trawl; CG = Campbell grab. Sources of material: ATLANTIS, ATLANTIS II and CHAIN samples sent by Dr. H. L. Sanders; GOSNOLD samples sent by Dr. R. L. Wigley.

According to the first report published by Sanders, Hessler & Hampson (1965), the bottom temperatures likely to be encountered in the *C. sandersi* habitat are between 2.3 and 2.7°C, with a slightly higher temperature (3.5°) towards its upper limit. The sediments in which *C. sandersi* occurs are all soft, being clayey silts, silty clays, and clays.

The continental rise and abyssal plain stations where *C. sandersi* occurs have a rather impoverished fauna, compared with that of the nearby continental slope. At most of these stations, *C. sandersi* is the only pogonophore, and contributes less than 1 per cent of the total fauna, by number. Polychaeta contribute about 50 per cent, Crustacea 30 per cent and Echinodermata are practically absent.

***Crassibrachia brasiliensis*, gen. et sp. nov.**

Occurrence.—CHAIN cruise 35, station 12; Apr. 6, 1963; 07°09'S, 34°25.5'W; depth 768-805 meters.

Material.—Many fragments of tubes, containing about 25 animals of both sexes and embryos.

Holotype.—U. S. National Museum No. 36130.

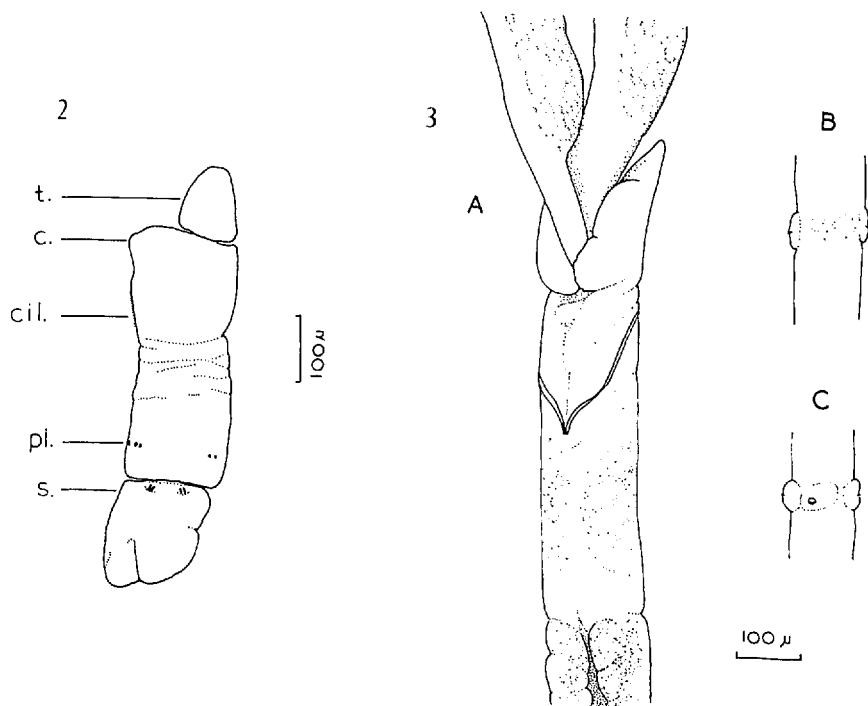
Description.—Like *C. sandersi*, the animals have to be squeezed out of their tubes, and many of them have been damaged in the process. There are two tentacles, without any pinnules, but with a band of vesicular gland cells along one side of each, covering about half the surface (Fig. 3, A). The forepart is 0.68-0.85 mm long, with a length/diameter ratio of about 6 to 1. The cephalic lobe is like that of *C. sandersi*, but the transverse grooves between the tentacles and bridle are less well defined and are sometimes missing. The bridle keels are colorless, or very pale yellow, and on the dorsal side they are separated by a furrow as in *C. sandersi*. On the ventral side they approach one another closely, but do not fuse (Fig. 3, A). The lateral patches of yellowish epidermal cells are placed towards the posterior end of the forepart and do not extend right up to the bridle as they do in *C. sandersi*. The trunk epidermis contains many vesicular mucus cells, like those of the tentacles, giving it a "bubbly" appearance. The granular epidermal cells on the metameric papillae are white, yellow, or brownish-yellow. Adhesive plaques appear on or behind the 5th papilla and occur on alternate papillae, usually on the anterior edge of each papilla, and not on separate cushions as in *C. sandersi*. The bubbly epidermis continues as far back as the region with enlarged papillae, where there are as many as 15 papillae, each tipped by a cuticular plaque 18-20 μ across. The girdles are similar to those of *C. sandersi*, and their toothed platelets are about the same size and shape. The postannular region has papillae arranged in rows of three (Fig. 3, B, C), opposed by very small dorsal shields. The spermatophores are a little longer than those of *C. sandersi*, ranging from 100-130 μ .

Measurements.—The tentacles range to 4 mm long, the forepart 0.68-0.85 mm, the preannular region to 10 mm (mature male), and the metameric region is about 1.6 mm. The posterior setigerous bulb has not been found.

Tube.—The tubes are black with brownish transparent portions at both ends, just as in *C. sandersi*; the slight segmentation and smooth surface of the remainder are also similar. The greatest diameter is 0.225 mm.

Embryos.—Two tubes contain embryos, but in such poor condition that they cannot be compared with those of *C. sandersi*.

C. brasiliensis is very similar to *C. sandersi* and may perhaps be only a variety of it, but there are constant differences in the arrangement of



FIGURES 2, 3.—2, *Crassibrachia sandersi*: embryo in side view (c, cephalic lobe; cil, cilia; pl, toothed platelets; s, metasomal setae; t, tentacle).—3, *Crassibrachia brasiliensis*: A, forepart and tentacle bases, ventral view; B, postannular dorsal shield; C, postannular row of papillae.

the gland cells on the tentacles, the ventral points of the bridle keels, and the epidermis of the anterior part of the trunk. These differences seem adequate to separate two species, especially when they are widely separated geographically and inhabit substantially different depths in the ocean. Other morphological differences found frequently, but not invariably, are: the smaller patches of granular epidermal cells on the forepart in *C. brasiliensis*, its paler bridle keels, its lack of cushions beneath adhesive plaques on the metameric papillae, its fewer postannular papillae, and its slightly larger spermatophores.

SYSTEMATIC POSITION OF *Crassibrachia*

Two orders of Pogonophora were originally designated by Ivanov (1963) on the basis of several characters. The fundamental character, arrangement of the paired coelomoducts in the forepart, is often impossible to see in small, or imperfectly preserved specimens. As new genera have

TABLE 2
COMPARISON OF TWO-TENTACLED GENERA¹

	<i>Crassibrachia</i>	Atheceanephria		Thecanephria	
		<i>Siboglinoides</i>	<i>Nereilinum</i>	<i>Sclerolinum</i>	<i>Diplobrachia</i>
Number of tentacles	2	2	2	2	2-4
Pinnules present	—	+	+ / —	—	+
Mucus glands on tentacles	many	?	few	?	?
Pyriform glands in front of bridle	—	+	—	—	—
Annular groove between forepart and trunk	+	+	+	—	+
White "gland" cells:					
(1) on forepart	+	—	+	—	—
(2) on metameric region	+	—	+	—	—
Metameric papillae	separate	separate	ridges	ridges	separate
Adhesive plaques on metameric region	+	—	—	—	+
Number of girdles	2	4-5	2	0	2
Number of papillae per postannular row	3-6	1	1-3	—	2-5
Tube:					
Rings	—	+	+	—	+
Segments	+	+	—	—	+
"Collars"	—	—	—	—	+
Color	black	brown	white or brown	brown	brown

¹ Based on data from: Nielsen (1966); Ivanov (1961, 1963); Southward (1961); Webb (1964b).

been discovered and the known ones examined in detail, the validity of many of the other distinctions has become doubtful; Nielsen has already discussed this problem (1966). The remaining useful distinction is the shape of the spermatophores, which are fusiform in the Atheceanephria and flattened in the Thecanephria. However, *Crassibrachia* has spermatophores which are intermediate in shape between the two types. Sections of the forepart do not show the coelomoducts clearly. It seems probable that, because of the slight flattening of the spermatophores, *Crassibrachia* should be included in the Thecanephria.

At family level, *Crassibrachia*'s possession of two tentacles, adhesive plaques on the metameric papillae, very small postannular dorsal shields, flattened narrow spermatophores, and tube with stiff anterior end suggests

that it belongs to the Polybrachiidae. The dense blackness of the tube is equalled only by those of some Oligobrachiidae (*Oligobrachia ivanovi* and *Birsteinia vitjasi*). Within the family Polybrachiidae, *Crassibrachia*'s narrow spermatophores are almost paralleled by those of *Zenkevitchiana*. However, narrow spermatophores are also found in the two-tentacled *Diplobrachia japonica*, and the genus *Diplobrachia* seems to be the closest to *Crassibrachia*. Table 2 compares *Crassibrachia* with *Diplobrachia* and three other two-tentacled genera, and shows its clear differences from all of them. Ivanov (1961) and Webb (1964b) have both pointed out that the two-tentacled form seems to have evolved independently several times in the Pogonophora; the new genus seems to be another example of this.

SUMARIO

SOBRE UN NUEVO GENERO DE POGONOFORA DEL OCEANO ATLANTICO OCCIDENTAL, CON LAS DESCRIPCIONES DE DOS NUEVAS ESPECIES

Se describe un nuevo género de Pogonófora llamado *Crassibrachia* y es tentativamente asignado a la familia Polybrachiidae. Hay dos nuevas especies, ambas con dos tentáculos gruesos y ambas habitan negros tubos de alrededor de 0.2 mm de ancho. *C. sandersi* se presenta en el Atlántico norte, entre New England y Bermuda, a profundidades de 2,000-5,000 m, mientras *C. brasiliensis* se presenta frente a la costa del Brasil, a unos 800 m de profundidad.

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